Neuronal networks involved in low back pain,

Experimental studies

Akademisk avhandling

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av

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The thesis is based on the following papers:

I. Galea, MP, Hammar, I, Nilsson, E, Jankowska, E. Bilateral postsynaptic actions of pyramidal tract and reticulospinal neurons on feline erector spinae motoneurons. Journal of Neuroscience 2010; 30(3), 858-69.

II. Nilsson, E, Brisby, H, Rask, K, Hammar, I. Mechanical compression and nucleus pulposus application on dorsal root ganglia differentially modify evoked neuronal activity in the thalamus. Submitted.

III. Nilsson, E, Larsson, K, Rydevik, B, Brisby, H, Hammar, I. Evoked thalamic neuronal activity following DRG application of two nucleus pulposus derived cell populations: an experimental study in rats. Submitted.

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ABSTRACT

Low back pain is a common cause of disability, with a lifetime prevalence of up to 80%. A lumbar disc herniation, involving a bulging disc and/or leakage of the intervertebral disc's nucleus pulposus, may be a possible cause of back and sciatic pain. Low back pain has also been associated with dysfunctional control of the paraspinal muscles. The aim of this thesis was to study the neuronal networks involved in low back pain including sciatica. In paper I, the contribution of two descending tracts, the pyramidal tract and the reticulospinal tract to the activity of motoneurones innervating one of the muscles of the erector spinae (longissimus muscle) were investigated in the cat. In papers II and III, changes in evoked neuronal activity in the ventral posterior lateral (VPL) nucleus of the contralateral thalamus were investigated following an experimental disc herniation affecting the ipsilateral 4th lumbar (L4) dorsal root ganglion (DRG) in the rat. Paper II concerns the role of mechanical compression and application of nucleus pulposus to the DRG while paper III investigates the role of two individual cell populations of nucleus pulposus, notochordal and chondrocyte-like cells. The results in paper I show that central activation from pyramidal neurones to erector spinae muscle is primarily mediated via reticulospinal neurones, while a limited proportion is also mediated via interneurones activated by pyramidal tract neurones. In paper II, opposite effects on evoked neuronal activity in the VPL were found where the mechanical compression induced a decrease in neuronal activity and nucleus pulposus had a facilitating effect. In paper III, neither of the two cell populations of nucleus pulposus induced an increase in neuronal activity resembling the increase reported previously following application onto the DRG of whole nucleus pulposus tissue. This thesis investigates some of the complex neuronal networks likely to be involved in low back pain, both directly and indirectly. Insights gained from the use of animal models will contribute to our ultimate understanding of the complicated processes that operate during the establishment and maintenance of low back pain including sciatica.

Keywords: low back pain, disc herniation, pyramidal tract, reticulospinal tract, longissimus muscle, nucleus pulposus, VPL, thalamus, rat, cat

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